

ZOOLOGY.—A new crayfish of the genus *Procambarus* from South Carolina (Decapoda: Astacidae). HORTON H. HOBBS, Jr., Samuel Miller Biological Laboratories, University of Virginia. (Communicated by Fenner A. Chacé, Jr.)

The first specimen of the species described here was collected on February 4, 1934, by L. M. Mace from near Barnwell, Barnwell County, S. C. Since that time a number of attempts have been made to secure a series of specimens on which to base the description of the species as well as to ascertain the extent of its range. These attempts have met with only slight success, for at the present there are but 118 specimens available from seven localities. On the basis of these collections it may be said that *Procambarus echinatus* occurs in the Salkehatchie River and in the headwater streams of the Edisto River in Bamberg, Barnwell, and Aiken Counties, S. C.

The closest relative of *Procambarus echinatus* appears to be *Procambarus dupratzi* Penn (1953: 1), which is reported to occur in eastern Texas and western Louisiana. These occupy, respectively, the most eastern and western limits of the range of the Spiculifer Group, and with *Procambarus natchitochae* Penn (1953: 5), the range of which appears to be confined to southern Arkansas and northern Louisiana, probably represent more nearly the ancestral stock of the group than do the remaining species. Consequently, it appears that the more "primitive" members are occupying the periphery of the range of the group.

Because at present Dr. George H. Penn is conducting a study of speciation in the Spiculifer Group, no attempt is made to summarize the ranges of the other species: *P. spiculifer* (LeConte, 1856: 401), *P. versutus* (Hagen, 1870: 51), *P. vioscai* Penn (1946: 27), *P. penni* Hobbs (1951: 273), *P. suttkusi* Hobbs (1953a: 173), and *P. raneysi* Hobbs (1953b: 412).

I wish to acknowledge with thanks the kindness of Dr. Penn in lending me two lots of specimens from the Tulane Collection and of Dr. G. Robert Lunz, Jr., formerly of the Charleston Museum, who lent me the first specimen of this new species I had seen. Also I express my appreciation to the following who have aided me in securing

specimens of this new species: Dr. R. D. Suttkus, Dr. W. R. West, E. A. Crawford, and T. R. Bello.

Procambarus echinatus,¹ n. sp.

Diagnosis.—Rostrum with lateral spines; acumen spiculiform and constituting 41.6–52.0 percent of the total length of the rostrum; postorbital ridges terminating in spines; suborbital angle absent; lateral surface of carapace with two or more spines present just caudad to cervical groove; areola 2.5–4.2 times longer than broad and constituting 21.3–27.4 percent of entire length of carapace. Simple hooks present on ischiopodites of third and fourth pereopods that extend proximad of distal end of respective basipodites, neither of the latter of which bears an opposable tubercle. First pleopod of first form male (Figs. 1, 5) terminating in four parts: mesial process subspiculiform with only the tip corneous; cephalic process corneous, slender and lying laterad of the central projection; caudal element represented by a truncate poorly defined caudal knob from which arises the subacute, scalelike, corneous caudal process; central projection, the most conspicuous of the terminal elements corneous, subacute and directed at an angle of about 70° to the main shaft of the appendage. Annulus ventralis (Fig. 12), slightly movable and partially concealed by the underhanging multituberculate sternum lying immediately cephalad of it, more than twice as long as broad; a transverse cephalically situated ridge is interrupted by a longitudinal median furrow which continues caudally as the sinuous sinus almost to the midcaudal margin of the annulus; the fossa lies near the median line immediately caudad of the transverse ridge.

Holotypic male, form I.—Body subovate, slightly compressed laterally; abdomen shorter than carapace (59.2–64.0 mm). Height and width of carapace subequal in region of caudo-dorsal margin of cervical groove (30.0–29.5 mm).

Areola relatively broad and short, about 4.2 times as long as wide with nine fine punctations

¹ *Echinatus*, Latin, set with prickles, prickly. Chosen because of the well-developed spines on the carapace and cheliped of this species.

in narrowest part. Cephalic section of carapace about 2.5 times as long as areola (length of areola about 28.3 percent of entire length of carapace).

Rostrum long with acumen extending beyond peduncle of antennule, excavate; sides convex and terminating at base of acumen in acute cephalolaterally directed spines. Acumen longer than half the remainder of rostrum (10.1 mm). Margins of rostrum not swollen or conspicuously elevated. Upper surface with a few minute punctations. Subrostral ridges poorly developed and not evident in dorsal aspect.

Postorbital ridges prominent, tuberculate, grooved dorsolaterad, and terminating cephalad in acute spines. Suborbital angle absent; branchiostegal spine well developed. Each side of carapace with a row of seven to nine tubercles and spines immediately caudad of cervical groove; upper surface of carapace punctate and lateral surface very strongly granulate.

Cephalic section of telson with two spines in each caudolateral corner. Epistome with a small cephalomedian spine (see fig. 3).

Antennules of the usual form with a strong acute spine present on ventral side of basal segment.

Antennae broken (see description of allotype and morphotype). Antennal scale long, moderately broad; widest slightly proximad of midlength; outer distal margin with a moderately strong spine.

Chela somewhat depressed with the palm somewhat inflated; outer margin of hand slightly concave at base of immovable finger. Hand entirely tuberculate. Inner margin of palm with a row of eight tubercles; a row of four tubercles immediately above this row and a single tubercle below it near distal end; a moderately prominent knoblike tubercle present on lower surface of palm at base of dactyl. Opposable margin of dactyl with a row of 20 knoblike tubercles, fourth from base largest but not forming a distinct emargination; upper surface of dactyl with no distinct longitudinal ridge but with tubercles proximad and setiferous punctations distad; mesial margin of dactyl with a row of 10 tubercles that diminish in size distally; lower surface of dactyl similar to upper surface. Opposable margin of immovable finger deeply concave with an upper row of 19 tubercles, the fifth from base largest, and a distal lower row of six of which the second from base is largest; minute denticles between the tubercles of each

row and between the two rows; upper surface of immovable finger with a distinct submedian longitudinal ridge flanked proximally by tubercles and distally by setiferous punctations; lateral surface of immovable finger convex (i.e., distal two-thirds of finger bent mesiad) with tubercles along basal one-third, and distal two thirds with a row of setiferous punctations; lower surface of finger similar to upper surface.

Carpus of first right pereiopod with a broad longitudinal depression flanked on each side by tubercles in poorly defined rows; submedian furrow interrupted distally by a small tubercle near distal margin of podomere. Mesial surface with one large submedian tubercle with a few smaller ones at base and one large one on upper distal margin; below the large submedian tubercle just mentioned are four somewhat smaller ones; lower distal margin with the usual two large tubercles with a row of three small ones proximad of the more mesial tubercle; lateral surface with punctations and a few scattered tubercles.

Merus of first right pereiopod with a few small tubercles and scattered punctations on lateral surface; upper surface with tubercles along entire length, except near distal extremity, with two of the more distal ones larger than the others; mesial surface with a few tubercles distally and somewhat excavate along middle three-fifths, producing a longitudinal furrow near lower margin. Lower surface with two rows of spikelike tubercles, an outer one of 5 and an inner one of 13; two or three additional small tubercles present between and to the sides of these two rows.

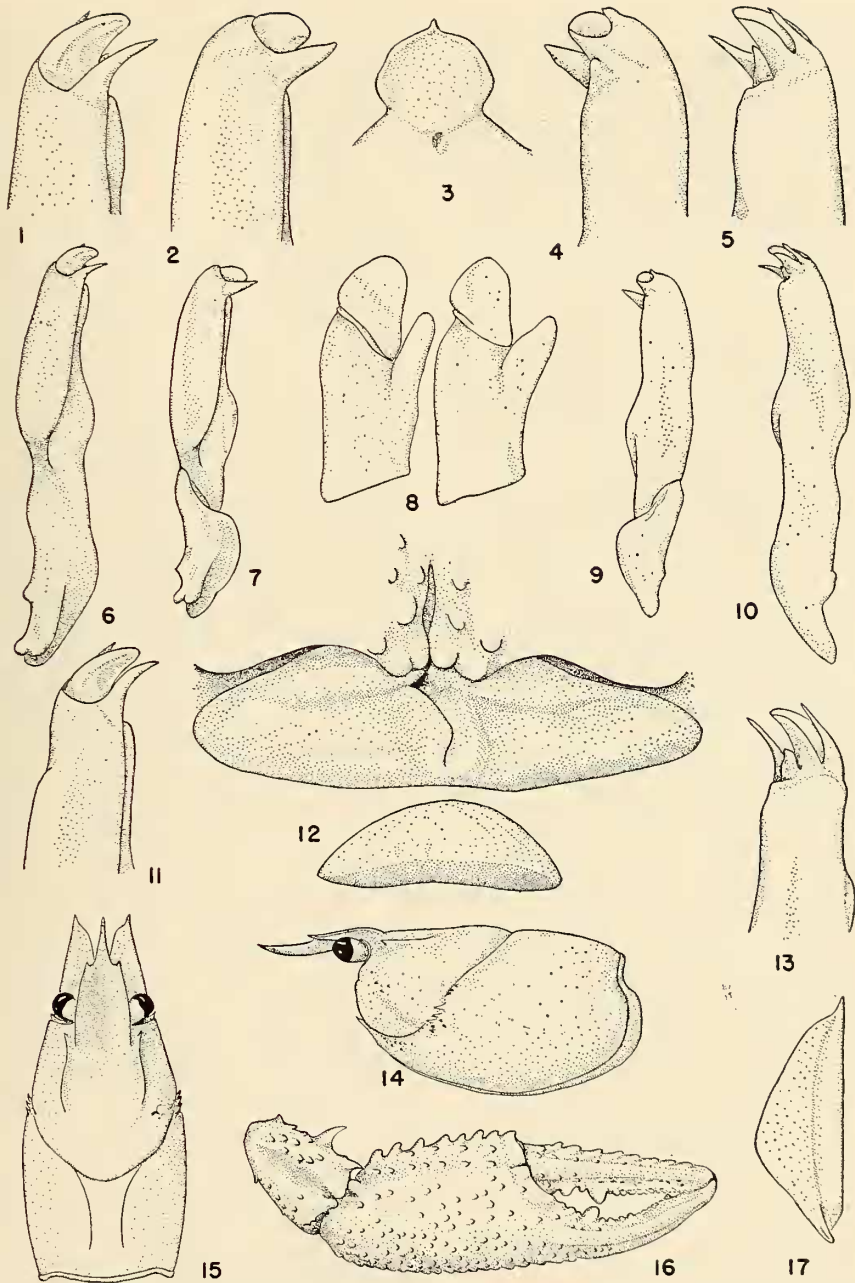
Ischiopodite of first right pereiopod with a row of four tubercles continuing from the lower mesial row on merus.

Basipodite of first right pereiopod without tubercles.

Coxopodite of first right pereiopod with no cephalically projecting spine but with a small caudally projecting one on caudomesial angle.

Hooks present on ischiopodites of third and fourth pereiopods; hooks simple and extend proximad of distal end of their respective basipodites; basipodites bear no opposable tubercles. Coxopodites of fourth and fifth pereiopods with caudomesial projections: that on fourth knoblike, that on fifth more compressed and more sharply defined.

First pleopod reaching coxopodite of third



FIGS. 1-17.—*Procambarus echinatus*, n. sp. (pubescence removed from all structures illustrated): 1, Mesial view of distal portion of first pleopod of holotype; 2, mesial view of distal portion of first pleopod of morphotype; 3, epistome of holotype; 4, lateral view of distal portion of first pleopod of morphotype; 5, lateral view of distal portion of first pleopod of holotype; 6, mesial view of first pleopod of holotype; 7, mesial view of first pleopod of morphotype; 8, basipodites and ischiopodites of third and fourth pereopods of holotype; 9, lateral view of first pleopod of morphotype; 10, lateral view of first pleopod of first form male from Aiken County, S.C.; 11, mesial view of distal portion of first pleopod of first form male from Aiken County, S.C.; 12, annulus ventralis of allotype; 13, lateral view of distal portion of first pleopod of first form male from Aiken County, S.C.; 14, lateral view of carapace of holotype; 15, dorsal view of carapace of holotype; 16, distal podomeres of cheliped of holotype; 17, antennal scale of holotype.

pereiopod when abdomen is flexed. Tip terminating in four distinct parts (Figs. 1, 5). Mesial process spiculiform and directed caudad. Cephalic process, lying laterad of central projection, acute, corneous, and directed caudad. Caudal element represented only by the small corneous, laterally compressed caudal process. Central projection prominent, corneous and directed caudad similarly as the cephalic process.

Allotypic female.—Differs from the holotype in the following respects: Each side of carapace with a row of seven or ten tubercles and spines; antenna extends caudad to last abdominal segment; row of tubercles on palm above marginal row consists of six; opposable margin of dactyl with a row of 14 tubercles, fourth from base largest; mesial margin of dactyl with a row of 11 tubercles; opposable margin of immovable finger with a row of 11 tubercles, third from base largest, and entire finger only slightly bent mesiad; fewer tubercles present on carpus of chela but major ones situated as in holotype; mesial row of tubercles on lower surface of merus with only 12 tubercles.

Annulus ventralis partially obscured in ventral aspect by multituberculate prominences which extend caudad from sternum immediately cephalad of annulus. Annulus spindle shaped with the greatest length in the transverse axis; cephalic half with an irregular transverse ridge, and caudal half with a median prominence; sinus originates near median line on caudal surface of cephalic ridge and forms a sinuous line which extends caudad almost to midcaudal margin of annulus (see Fig. 12).

Morphotypic male, form II.—Differs from the holotype or allotype in the following respects: Antenna extends caudad almost to caudal margin of telson; opposable margin of dactyl with 16 tubercles; opposable margin of immovable finger with an upper row of 17 tubercles and a lower distal one of four; ischiopodite of first pereiopod with three or four tubercles; secondary sexual characters as in holotype but much reduced in size.

First pleopod with all processes represented, although none corneous, and while less well defined are all similarly situated as in holotype but directed more caudad (see Figs. 2, 4).

Measurements.—As follows (in millimeters):

	Holotype	Allotype	Morpho- type
Carapace—height	30	24.8	25.7
width	29.7	25.2	26.0
length	64.0	54.5	54.9
Areola—length	18.1	14.5	15.0
width	4.3	4.4	4.2
Rostrum—length	22.5	19.2	19.3
width	9.9	8.5	8.5
Right chela—			
length of inner margin of palm	21.4	9.7	13.0
width of palm	21.0	9.7	12.7
length of outer margin of hand	59.5	29.0	37.0
length of dactyl	32.1	16.3	20.7

Type locality.—Salkehatchie River, 1.9 miles south of Barnwell, Barnwell County, S. C., on State Highway 3. Here the stream varies from 10 to 100 feet across with a sand and mud bottom. The water is dark brown, with little silt suspension, and in many places flows with a moderate current through dense growths of *Vallisneria* and *Saururus cernuus*. My specimens were taken after dark resting on eel grass in the swifter reaches of the stream and on submerged roots near the surface of the water.

Disposition of types.—The holotypic male, the allotypic female, and the morphotypic male are deposited in the United States National Museum (nos. 99180, 99181, 99182, respectively). The following paratypes are retained in my personal collection at the University of Virginia: 9-349-7a—type locality (1 ♀), W. R. West and H.H.H., coll.; 4-1955-6a—type locality (1 ♀, 4 juv. ♂♂, 1 juv. ♀), E. A. Crawford, T. R. Bello and H.H.H., coll.; 9-349-6a—Georges Creek, 9 miles southeast of Barnwell on State Highway 64 (1 ♂II, 3 juv. ♀♀), W. R. West and H.H.H., coll.

Specimens examined.—In addition to the types mentioned above, the following specimens from the Edisto River system in Aiken County, S. C., are available: 6-749-2—trib. s. fork of Edisto River, 11.2 mi. n. of Aiken (1 ♂II), R. D. Suttkus, coll.; 8-1952-2a—creek, 10.7 mi. n. of Aiken on U. S. Rt. 1 (5 ♂♂II, 13 ♀♀, 3 juv. ♂♂, 4 juv. ♀♀), H.H.H., coll.; 4-1955-4a—Bridge Creek, 10.6 mi. n. of Aiken on U. S. Rt. 1 (1 ♂I, 4 ♀♀II, 8 ♀♀, 13 juv. ♂♂, 12 juv. ♀♀), E. A. C., T. R. B., and H. H. H., coll.; 4-1955-5, south fork of Edisto River, 12.3 mi. n. of Aiken on U. S. Rt. 1 (2 ♀♀, 1 juv. ♂), E.A.C., T.R.B., and H.H.H.; 9-1355-1a, same as preceding (1 ♂I, 3 ♀♀II, 3 ♀♀, 2 juv. ♂♂, 4 juv. ♀♀), H.H.H., coll.; 4-1955-3a—Shaws Creek, 16.1 mi. sw. of Wagener

on St. Rt. 215 (4 juv. ♂♂, 1 juv. ♀) E.A.C., T.R.B., H.H.H., coll.; Tulane University (T.U.) 3311-17.5 mi. s. of Batesburg on St. Rt. 391 (1♂ II, 8 juv. ♂♂, 4 juv. ♀♀), G. H. Penn and J. B. Black, coll.; T.U. 3312-5.7 mi. ne. of Aiken on St. Hy. 391 (1♂ II, 3♀ ♀, 1 juv. ♂, 4 juv. ♀♀), G.H.P. and J.B.B., coll.

Color notes.—Carapace olive-green dorsad, fading ventrally into creamy white with ridges edged in black. In addition to the ground color of carapace the cephalic region is marked by a broad distinctly U-shaped black yolk following the contour of the cervical groove; however, base of U not continuous but broken between attachments of mandibular muscle. Thoracic portion of carapace with a similarly disposed and broken U-shaped black marking—the broken portion occurring at caudal end of areola. Abdominal segments greenish with caudal portion bright blue bearing reddish-purple and vivid red markings. Chela reddish black with white tubercles; distal portion of fingers red but fading at the extreme distal ends into the yellow corneous spines.

Variations—While there are a considerable number of variations from specimen to specimen, none of these, including ratios of body parts, has been demonstrated to be correlated with any of the several local populations represented. Indeed, there is almost as much variation between individuals collected from the type locality as there are between any one of them and specimens taken elsewhere. Only in the number of spines along the cervical groove and in minor details of the first pleopod of the male may specimens from the Edisto drainage be distinguished from those from the Salkehatchie. Specimens from the latter all have from three to five spines on each side of the carapace, whereas

those from the Edisto usually have only two, although as many as four are present on one side of two of the specimens examined. There are so few first form males available, one from the Salkehatchie and two from the Edisto, that it is not known how much variation does exist; for this reason the first pleopod of specimens from both drainage systems are figured (cf. Figs. 1 and 11; 5 and 13).

Relationships.—*Procambarus echinatus* has its closest affinities with *Procambarus dupratzi* (Penn) but may readily be distinguished from the latter by the absence of a carina on the rostrum and by the form of the caudal element of the first pleopod of the first-form male.

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Accurate and minute measurement seems to the non-scientific imagination a less lofty and dignified work than looking for something new. But nearly all the grandest discoveries of science have been but the rewards of accurate measurement and patient long-continued labor in the minute sifting of numerical results.—LORD KELVIN, *Report of the British Association for the Advancement of Science* **41**: 91. 1871.